

# Master of Science in Physics

## (M. Sc. in Physics)

### INTRODUCTION

This program will deepen and strengthen the physics knowledge among physicists. And it will educate scientists who are able to apply physics in different sectors. In addition, this program provides advanced education and research opportunities to exceptional students by providing a research environment that fosters collaboration, creative thinking and publishing of findings in nationally and internationally recognized journals. This Master of Science in Physics is a unique program in Palestine; it is the first physics master program in Palestine to contain computational physics as a core module with an additional module on Monte Carlo Methods in its elective. Due to the broad class of problems computational physics deals, it is an essential component of modern research in different areas of physics, namely: accelerator physics, radiation transport, plasma physics, simulating physical systems (using e.g. molecular dynamics), solid state physics, statistical physics, soft condensed matter physics, etc. A field related to computational condensed matter is computational statistical mechanics, which deals with the simulation of models and theories that are difficult to solve otherwise. Computational statistical physics makes heavy use of Monte Carlo-like methods. This program will apply the most advanced physics applications in different areas within the Palestinian community in addition to opening the possibility of working in neighboring countries. This program will provide the community with skilled graduates who are able to work in a broader market than just working as teachers of physics and natural sciences. It is worth to mention that there are no Master programs in Physics to serve the educational need of the growing Southern Area of the West Bank. The Graduates will be able to develop the ability to synthesize and integrate information and ideas. Also, by taking this Master degree it will increase the job opportunities in the universities, high schools, factories, companies and other institutions for our graduate.

### Admission Requirements

1. Candidates for the program require successful completion of a bachelor's degree in physics, applied physics or a closely-related discipline with cumulative average of good or above or its equivalent.
2. Fulfilling the English Language requirement by either passing the TOFEL Test or one of the standard international tests, or by studying and passing the course "English for Graduate Students".
3. Applicants holding a degree without sufficient concentration in the area of the intended Master's degree, may be required to complete additional courses beyond those outlined as required for degree completion.
4. The Physics Graduate Admissions Committee will review all applications and recommend admission for a limited number of suitable candidates. Students are normally admitted as full-time students.

## Program Axis

- ✓ This Master of Science in Physics program consists of 36 credit hours
- ✓ The program runs over four semesters, i.e. two years.
- ✓ There are two tracks for the program: the thesis track and the comprehensive exam track.
- ✓ The program builds on a foundational set of six core courses (18 credit hours) plus additional electives.

## Faculty members

Highly qualified teaching staff with strong teaching and research experience.

## Assistantship

It is expected that a number of teaching assistantships will be granted to students based on academic excellence.

## Research Possibilities:

The program provides the right environment in conducting research under the supervision of skilled professors and researchers in the areas of applied, theoretical, and computational physics.

## Objectives:

1. Graduate specialized and skilled academic staff in Physics.
2. Encourage candidates to study at home country while working.
3. Promote and foster scientific research among university graduates.
4. Qualify students to pursue a PhD in Physics or any related field.

## Outcomes:

1. Knowledge and understanding of most fundamental physical laws and principles and competence in the application of these principles to diverse areas of physics.
2. An ability to solve problems in physics using appropriate mathematical skills and tools.
3. An ability to execute and analyze critically the results of an experimental investigation or theoretical modeling and to draw valid conclusions with an estimate of the uncertainty in the result. The ability to critically compare experimental results with the predictions of theory.
4. Knowledge of the fundamental principles and applications of some advanced areas of physics at, the forefront of the discipline.
5. An ability to use competently computational software in problem solving.
6. Use computational techniques to describe the physical world, selecting appropriate equations, constructing mathematical models, interpreting results and critically comparing them with observation.
7. An ability to communicate scientific information especially in the form of clear and accurate scientific reports.

## Work fields of graduates:

This program opens job opportunities for graduates in many sectors and institutions as follows:

- ✓ Government related jobs and ministries including the ministry of education, ministry of health and ministry of energy and the environment.
- ✓ College/University/University Affiliated Research Institutes
- ✓ Elementary, middle and secondary schools
- ✓ Private Sectors including high hi-tech companies, contractors, utilities, and a diverse group of smaller companies either locally or foreign.
- ✓ Research units and centers.
- ✓ Self-employment, such as consultants or tutors.
- ✓ Some of the master graduates may have the opportunity to work in the field of computer programming and information technology.
- ✓ Post-graduate studies for a PhD degree.

## Academic plan:

### A. Thesis track hours are distributed as follows:

No.	Requirements	Cr.
1.	<b>Core</b>	<b>18</b>
2.	<b>Electives</b>	<b>12</b>
3.	<b>Thesis</b>	<b>6</b>
Total Credit Hours		<b>36</b>

### B. Comprehensive exam track hours are distributed as follows:

No.	Requirements	Cr.
1.	<b>Core</b>	<b>18</b>
2.	<b>Electives</b>	<b>12</b>
3.	<b>Seminar 1, Seminar 2</b>	<b>6</b>
Total Credit Hours		<b>36</b>

### 1. Core courses: (المساقات الاجبارية)

**Credit hours needed: (18)**

Course Name	Prerequisite	Parallel Requirement	Cr.	إسم المساق	Identification No.
Mathematical Physics	Mathematical Physics (APPH322)		3	الفيزياء الرياضية	MPHYS523
Classical Physics	Classical Mechanics (APPH310)		3	الفيزياء الكلاسيكية	MPHYS520
Quantum Mechanics	Quantum Mechanics II (APPH432)		3	ميكانيكا الكم	MPHYS522
Classical Electrodynamics	Electrodynamics (APPH422)		3	كهروديناميكيه كلاسيكية	MPHYS521
Statistical Physics	Modern Physics (APPH250)		3	الفيزياء الإحصائية	MPHYS524
Computational Physics	Computer Programming (GE114)		3	الفيزياء المحوسبه	MPHYS625
Total			18	المجموع	

## 2. Electives (المساقات الاختيارية)

- Credit hours needed for thesis track: (12)
- Credit hours needed for comprehensive exam track: (12)

Course in English	Cr.	المساق باللغة العربية	Identification No
Monte Carlo Methods in Physics	3	طرق مونت كارلو في الفيزياء	MPHYS638
Advanced Computational Fluid Dynamics	3	ديناميكا الموائع المحوسبة المتقدمة	MPHYS641
Nuclear Physics	3	الفيزياء النووية	MPHYS626
Elementary Particle Physics	3	فيزياء الجسيمات الأولية	MPHYS627
Atomic and Molecular Physics	3	الفيزياء الذرية و الجزيئية	MPHYS628
Solid State Physics	3	فيزياء الحالة الصلبة	MPHYS629
Plasma Physics	3	فيزياء البلازما	MPHYS630
Nanophysics: technology and advanced materials	3	فيزياء: تكنولوجيا و مواد متطورة نانو	MPHYS631
Physics of Energy and the Environment	3	فيزياء الطاقة و البيئة	MPHYS632
Advanced Radiation Physics	3	فيزياء الاشعاع المتقدمه	MPHYS633
Quantum Optics	3	بصريات الكم	MPHYS635
Shielding and Commissioning	3	التدريع و التكاليف	MPHYS636
Medical Imaging	3	التصوير الطبي	MPHYS637
Health and Occupational Physics	3	فيزياء الصحة و المهنيه	MPHYS634
Special Topics in Physics	3	مواضيع خاصة في الفيزياء	MPHYS639
Methods in Experimental Physics	3	طرق في الفيزياء التجريبية	MPHYS640
Total	45	المجموع	

<b>First Semester</b>					
Course Name	Prerequisite	Parallel Requirement	Cr.	اسم المساق	Identification No.
Mathematical Physics	Mathematical Physics (APPH322)		3	الفيزياء الرياضية	MPHYS523
Classical Physics	Classical Mechanics (APPH310)		3	الفيزياء الكلاسيكية	MPHYS520
Quantum Mechanics	Quantum Mechanics II (APPH432)		3	ميكانيكا الكم	MPHYS522
<b>Total</b>			9	المجموع	

<b>Second Semester</b>					
Course Name	Prerequisite	Parallel Requirement	Cr.	اسم المساق	Identification No.
Classical Electrodynamics	Electrodynamics (APPH422)		3	كهروديناميكيه كلاسيكية	MPHYS521
Statistical Physics	Modern Physics (APPH250)		3	الفيزياء الإحصائية	MPHYS524
Elective			3		
<b>Total</b>			9	المجموع	

<b>Third Semester</b>					
Course Name	Prerequisite	Parallel Requirement	Cr.	اسم المساق	Identification No.
Computational Physics	Computer Programming (GE114)		3	الفيزياء المحوسبه	MPHYS625
Elective			3		
Elective			3		
<b>Total</b>			9	المجموع	

<b>Fourth Semester (For Thesis Track Students)</b>					
Course Name	Prerequisite	Parallel Requirement	Cr.	اسم المساق	Identification No.
Thesis			6	الاطروحة	
Elective			3		
<b>Total</b>			9	المجموع	

<b>Fourth Semester (Comprehensive Exam Track Students)</b>					
Course Name	Prerequisite	Parallel Requirement	Cr.	اسم المساق	Identification No.
Seminar 1			3	حلقة بحث 1	MPHYS601
Seminar 2			3	حلقة بحث 2	MPHYS602
Elective			3		
<b>Total</b>			9	المجموع	

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